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LIFE HISTORY AND LABORATORY REARING OF *EUSCHISTUS ICTERICUS* (HEMIPTERA: PENTATOMIDAE), WITH DESCRIPTIONS OF IMMATURE STAGES

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Abstract.—The life history of *Euschistus ictericus* was studied in southern Illinois, and the immature stages were described. The bug was also reared from egg to adult in the laboratory. Adults emerged from overwintering sites in early May, began feeding on *Carex comosa* Boott, and reproduced shortly thereafter. Eggs were generally laid on *C. comosa* and nymphs were found only on this plant. No individuals were found after mid-August. *E. ictericus* was reared on green beans under a 16L:8D photoperiod and constant temperature of 23.9 ± 1.1°C. The incubation period averaged 7.33 days. Durations of the 5 subsequent stadia averaged 3.99, 7.72, 7.27, 9.03, and 12.62 days, respectively. The external anatomy of the egg and each of the 5 nymphal instars is described.

Euschistus ictericus (L.) occurs from eastern Canada south to Florida, and west and southwest to Utah, Oklahoma, and Texas (McPherson, 1982). It has been collected on sedges, *Iris versicolor* L., water lilies, *Saururus cernuus* L., *Salix,* yellow thistle, cow-parsnip, *Cuscuta,* soybeans, and common mullein (McPherson, 1982).

Little has been published on the field life history of this stink bug. It overwinters as adults (Blatchley, 1895; Parshley, 1923). Torre-Bueno and Engelhardt (1910) found mating specimens on 24 July on water lilies in North Carolina. This paper presents information on the life history and laboratory rearing of *E. ictericus* and includes descriptions of the immature stages.

MATERIALS AND METHODS

Life history. On 12 June 1981, several adults, including copulating pairs, were observed on the heads, leaves, and stems of *Carex comosa* Boott growing in water near the shore of La Rue Swamp, Union County, Illinois. The presence of copulating adults suggested a life history study was possible and, therefore, a study was conducted from June 1981 to July 1982. Collection of data during 1981 ended in August after the insects left the host plants. During 1982, data were collected from April to July, before the bugs appeared on, and after they left the plants.

Data were collected weekly during the study and consisted primarily of counts of all stages present. Few animals were actually collected because the population size appeared small. The only exceptions were a few egg clusters and young nymphs that were reared to adults to confirm their identities and, with nymphs, to confirm their instars when collected. Data gathered during the 2 years of the study were combined to gain a better understanding of the annual life cycle.

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Laboratory rearing. Fifteen adults (9♂♂, 6♀♀) were collected from *C. comosa* at La Rue Swamp on 12 June 1981, taken to the laboratory, and placed in a 1-qt. (ca. 0.95-liter) Mason jar covered on the bottom with filter paper. Green snap beans (*Phaseolus vulgaris* L.) served as food and were placed on end in the bottom of the jar. A strip of paper toweling was added which, together with the filter paper, increased absorption of excrement and provided a good walking surface for the nymphs. The jar was closed with wire screen and paper toweling and secured with the band of the 2-piece Mason jar lid. A cheesecloth strip (ca. 6 × 20 cm), which served as an oviposition site, was placed inside the jar with 1 end over the lip and held in place by the band.

The cage was examined daily for eggs. Cheesecloth, with attached egg clusters, was removed and placed on moist filter paper in the bottoms of petri dishes (ca. 9 cm diam., 2 cm depth) and covered with the lids. Water was added daily to keep the filter paper moist.

The first instars (an apparently nonfeeding stage) were also kept in the petri dishes. The second through fifth instars were kept in Mason jars prepared similarly to the oviposition cage except for the absence of cheesecloth.

Food, filter paper, and strips were changed every 3–4 days. The dishes and jars were kept in an incubator maintained at 23.9 ± 1.1°C and a 16L:8D photoperiod.

Descriptions of immature stages. The description of each stage is based on 10 individuals that were collected from the laboratory culture and preserved in 95 percent ETOH. The first instar is described in detail, but only major changes from previous instars are described for subsequent instars. Comparative statements refer to previous instars (e.g., "more numerous"). Length is measured from tip of tylus to tip of abdomen; width is measured across the mesonotum. Dimensions are expressed in mm as $\bar{x} \pm$ SE. Drawings were made with the aid of a camera lucida, measurements with an ocular micrometer.

RESULTS AND DISCUSSION

Life history. Fifty-nine adults, 70 eggs, and 35 nymphs were found during this study. Adults emerged from overwintering sites in early May and began feeding on the heads of *C. comosa.* Shortly thereafter, they were observed copulating on the heads, leaves, and stems of the host plant; as in many other pentatomoids (McPherson, 1982), the copulating position was end-to-end.

The 70 eggs were laid in 6 clusters, an average of 11.7 eggs/cluster (range, 6–14). These clusters and those deposited in the laboratory usually consisted of 2 to 4 rows of eggs. The first cluster was collected on 14 May and had been deposited on a head of *C. comosa.* The 5 remaining clusters were collected on 18 June; 4 had been laid on *C. comosa* (2 on heads, 2 on bracts) and 1 on *Sagittaria latifolia* Willdenow (on a leaf) that was growing in a stand adjacent to *C. comosa.*

No first or second instars were collected. Five third instars were collected between 4 June and 3 July, 12 fourths between 12 June and 30 July, and 18 fifths between 18 June and 6 August; all were collected on *C. comosa.* Adults occurred on *C. comosa* until mid-August; most (55.2 percent) were observed between 12 and 18 June.

From these limited data, it is difficult to decide whether *E. ictericus* was uni- or bivoltine at Pine Hills. Both interpretations are reasonable.

Laboratory rearing. The 230 eggs deposited (Table 1) were laid on the cheesecloth

Table 1. Duration (in days) of each immature stage of *E. ictericus*.

Stage	No. completing stadium	Days		
		Range	$\bar{x}$ ± SE	Cumulative mean age
Egg	227[a]	6–8	7.33 ± 0.04	7.33
Nymph				
1st instar	226	3–5	3.99 ± 0.05	11.32
2nd instar	205	6–15	7.72 ± 0.09	19.04
3rd instar	184	5–14	7.27 ± 0.10	26.31
4th instar	171	6–18	9.03 ± 0.13	35.34
5th instar	165	9–21	12.62 ± 0.15	47.96

[a] 230 eggs were laid.

in 14 clusters, an average of 16.4 eggs/cluster (range, 8–31). The incubation period averaged 7.33 days. The eye spots and mouth parts were visible in 3–4 days.

The first instars were gregarious and remained atop the egg shells unless disturbed. They apparently did not feed. The duration of this stadium averaged 3.99 days.

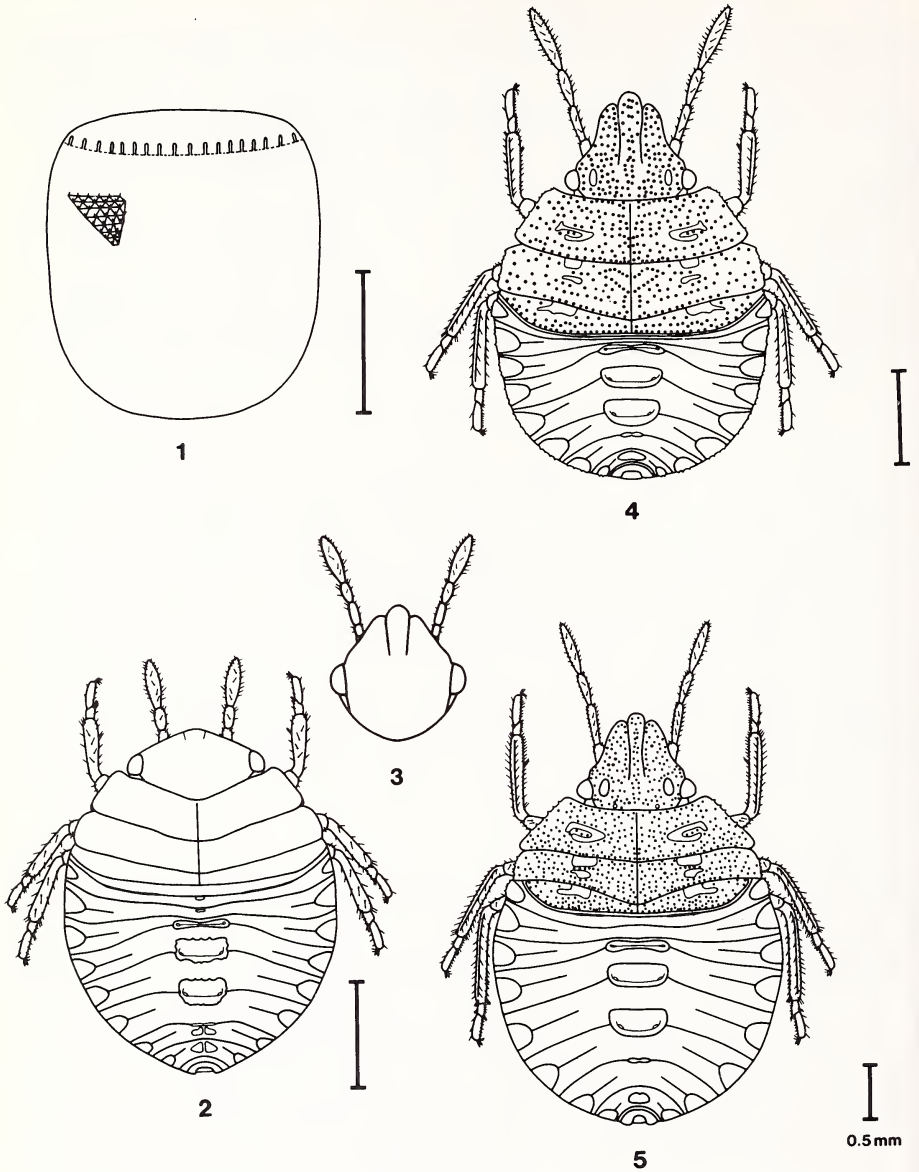
The durations of the second through fifth stadia averaged 7.72, 7.27, 9.03, and 12.62 days, respectively. Total developmental time from egg to adult averaged 47.96 days. Of the 226 individuals that began the second stadium, 73.0 percent (165 individuals) reached adults.

Descriptions of immature stages. EGG (Fig. 1). Length, 1.13 ± 0.01; width, 1.00 ± 0.01. Generally laid in clusters of 14; each egg kettle-shaped, yellowish white. Chorion with irregular triangular and quadrangular reticulations; spine at apex of each angle. Operculum present, surrounded by 34–38 micropylar processes, each process ca. 0.06 mm long and slightly dilated at tip.

FIRST INSTAR (Figs. 2, 3). Length, 1.67 ± 0.02; width, 1.23 ± 0.01. Body oval, greatest width at abdominal segments 2–3. Punctures present dorsally and ventrally, all punctures minute.

Head declivent, anterolateral margins sinuate; yellowish brown to light brown dorsally with vertex yellow medially and tylus reddish to yellowish brown, often with red U-shaped marking between eye and midline of head; tylus exceeding juga; line extending from each eye posteromedially and disappearing beneath pronotum. Eyes red. Antennae 4-segmented; segments 1–3 brownish to red; segment 4 largest, fusiform, reddish brown to brown; incisures albidus; distinct constrictions at junctures of 2–3 and 3–4; ratio of antennal segment lengths ca. 10:11:12:25. Ventral surface of head whitish to yellowish brown. Beak 4-segmented, whitish to brown, segments 3–4 darker.

Thoracic nota reddish brown to brown, yellow medially, yellow mediolongitudinal line extending from anterior margin of pronotum nearly to or reaching posterior margin of metanotum; lateral margins entire; pro- and mesonota sclerotized, posterior margins arcuate; metanotum sclerotized except posteriorly, posterior margin of metanotal plate slightly arcuate medially, bending cephalad laterally; faint calli occasionally present on all segments; intersegmental line between metanotum and first



Figs. 1–5. Immature stages of *E. ictericus*. 1. Egg. 2, 3. First instar. 4. Second instar. 5. Third instar.

abdominal tergum often sclerotized either side of midline ca. one-half way between lateral margin and midline of body. Pleura light brown; pro- and mesopleura fused to respective nota; metapleura separated from metanotal plate by membranous area. Spiracles located on posterior margins of pro- and mesopleura. Sterna concolorous with ventral surface of abdomen. Coxae whitish, each with central brown mark on lateral surface; trochanters pale brown; femora brownish with apices reddish; tibiae reddish with apices yellowish, front tibiae each with bifurcate spine on inner posterior margin of distal one-third; tarsi 2-segmented, yellowish, apex of segment 2 darker; tarsal claws and pulvilli brown to yellowish brown.

Dorsum of abdomen white, or yellow, with red markings; sparsely punctate light brown to brown medial and lateral plates present. Faint pseudointersegmental lines on all but first and last segments, each originating at inner margin of lateral plate. Eight medial plates present; plates 1–2 small, plate 2 may be weakly sclerotized; plate 3 narrowed medially; plate 4 subrectangular with markedly irregular margins, slightly narrower than, and 4 to 5 times medial length of, plate 3; plate 5 subtrapezoidal with markedly irregular margins, slightly narrower than, and 5 to 6 times medial length of, plate 3; plate 6 often consisting of anterior transverse strip and paired posterior pieces; plate 7 variable in shape, often split or partially split medially; plate 8 fused to laterals; paired ostioles of scent glands located on plates 3–5. Nine lateral plates present, subelliptical, extending dorsally and ventrally from margin of abdomen; plate 1 small; plates 2–6 largest; remainder generally decreasing in size posteriorly. Sterna generally concolorous with dorsum, occasionally redder; segments 5–9 occasionally with weakly sclerotized subrectangular medial plates, that of sternum 9 fused with laterals. Spiracles located on segments 2–8, those of segment 8 reduced, each with brown peritreme. A single trichobothrium located posteromesad to each spiracle on segments 3–7.

SECOND INSTAR (Fig. 4). Length, 2.15 ± 0.04; width, 1.77 ± 0.02. Body broadly pyriform; dorsum of head and thorax with numerous punctate brown spots, punctures large, brown; ventral punctures still minute.

Head less declivent, anterolateral margins more sinuate; white to yellow dorsally with posterior margin dark brown, oval brown spot slightly medial to each eye, red U-shaped markings of first instar absent, yellow area on vertex replaced by faint yellow V-shaped marking, tylus white to reddish. Antennal segments 1 and 4 brown; segments 2–3 reddish brown to brown, each red distally; incisures albidus to red; ratio of antennal segment lengths ca. 12:21:20:36. Ventral surface of head dark brown except for white area either side of beak and white to red strip beneath beak.

Thoracic nota white to yellow, lateral margins explanate, dentate, edged with brown (pro- and mesonota), posterior margins brown; mesonotum with medial area extended posteriorly; intersegmental line between metanotum and first abdominal tergum sclerotized either side of midline ca. one-half way between lateral margin and midline of body; pro- and metanota each with 1 pair, and mesonotum with 2 pairs, of brown calli. Pleura white, each edged with brown and with brown spots and brown longitudinal stripes. Sterna red. Coxae white, each with lateral edge and central spot brown; trochanters white; femora each with proximal one-half white, distal one-half brown, apex often red; tibiae reddish brown to brown, red basally, carinate; tarsi brown.

Dorsum of abdomen white to yellow with numerous, short, longitudinal, red markings. Medial and lateral plates with minute punctures. Medial plates 1–2 absent; plates 3–8 brown; plate 3 with transverse white stripe; plate 4 subtrapezoidal without marked irregular margins, ca. 3 times medial length of plate 3, transverse white marking present that is often anchor-shaped; plate 5 without marked irregular margins, ca. 4 times medial length of plate 3, white markings present and consisting of transverse anchor-shaped mark and short mediolongitudinal mark posterior to anchor; plate 6 small, linear, not divided into anterior strip and posterior pieces; plate 7 often undivided, white marking present medially; plate 8 with white marking present medially. Lateral plates white, margins brown, generally 1–4 brown spots in white areas. Ventrally, linear sclerite present posterior to each metacoxa. Sterna concolorous with dorsum in lateral one-half, whitish medially with sparse red markings; medial plates brown with minute punctures, now often on segments 4–9. Two trichobothria posterior to each spiracle on segments 3–7.

THIRD INSTAR (Fig. 5). Length, 4.04 ± 0.06; width, 2.40 ± 0.02. Dorsum of head and thorax with punctate brown spots limited primarily to humeri, remaining punctures more numerous and relatively smaller.

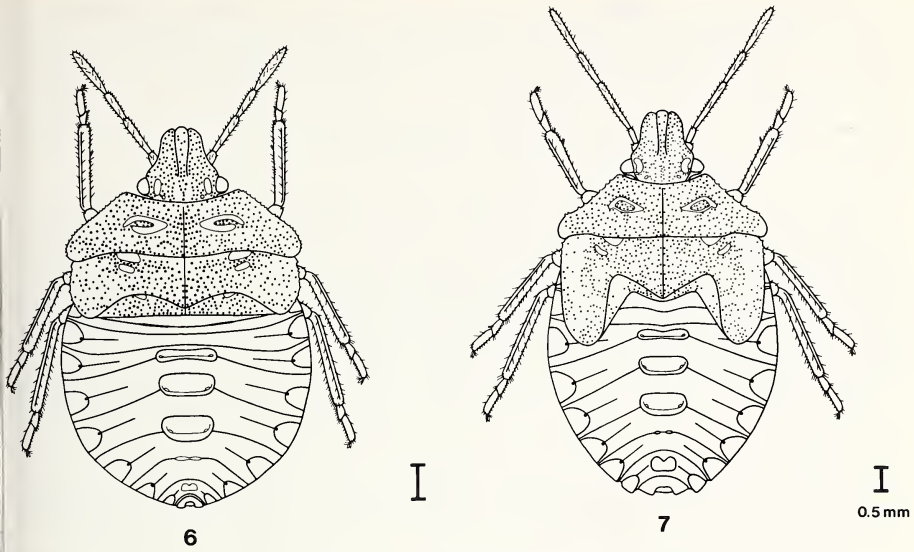
Head with anterolateral margins more sinuate; dorsally, yellow to yellow with lateral one-half of juga reddish, oval brown spot of second instar near each eye now yellow to yellowish brown; 2 red ocelli present posteromedially but often obscured by brown along posterior margin of head. Antennal segment 1 yellow to brown, with red to brown markings; segments 2–3 red; segment 4 reddish brown to brown; ratio of antennal segment lengths ca. 13:30:25:40. Ventral surface of head brown except for white areas either side of beak and around bases of antennae, yellow area which is often present between beak and eye, and white to red strip beneath beak.

Thoracic nota with paired calli yellow to brown; pronotum with medial area slightly extended posteriorly. Femora each with proximal two-thirds white, distal one-third mottled.

Dorsum of abdomen yellow with numerous short, longitudinal, yellow to red markings; terga 1–7 each with red to brown spot midway between lateral margin and midline of abdomen, spot may be obscure. Medial plate 3 yellow with brown anterior and posterior margins; plates 4–5 with markings similar to third instar but yellow instead of white, plates 3–5 often with brown spots on yellow areas; plates 7–8 yellow with brown spots. Lateral plates with brown spots small and more numerous. Sterna with medial plates on segment 4–9 varying from almost transparent with brown spots to brown; intersegmental lines between segments 2–3, 3–4, and 4–5 often sclerotized either side of midline.

FOURTH INSTAR (Fig. 6). Length, 6.20 ± 0.09; width, 3.62 ± 0.04. Dorsum of head and thorax with punctures more numerous in some areas and generally relatively smaller.

Head yellow dorsally with lateral one-third of juga reddish; ocelli now always visible. Antennal segment 1 yellow, apex brown, with red to brown spots; segment 2 yellow to reddish yellow; segment 3 yellow to red; segment 4 red to yellow proximally, brown distally; ratio of antennal segment lengths ca. 5:13:10:14. Ventral surface of head yellow except for lateral dark brown stripe extending from each eye at least to base of antennal segment 1, dark brown mark behind eye that may be continuous with dark brown mark on either side of midline along posterior margin



Figs. 6, 7. Immature stages of *E. ictericus*. 6. Fourth instar. 7. Fifth instar.

of head, and occasional pink spot beneath beak. Beak with segment 1 yellow to yellow with apex brown; segment 2 yellow to brown; segments 3–4 yellowish brown to brown.

Thoracic nota with brown borders along posterior margins reduced or absent; humeri with brown spots more numerous; calli yellow, those of meso- and metanota often with brown central spot. Meso- and metanotal wing pads ca. the same length, extending onto first abdominal segment. Pleura with brown spots and brown longitudinal stripes limited primarily to lateral one-half except for 1 brown spot at base of each coxa. Sterna yellow. Coxae white to yellowish white, each with light brown band on lateral edge absent and central brown spot occasionally absent; trochanters whitish yellow; femora yellow to reddish yellow proximally, yellow with reddish to brown spots distally; tibiae yellow to reddish brown, with red to brown markings; tarsal segment 1 yellow, apex often darker, segment 2 yellow basally, brown distally.

Dorsum of abdomen yellow with red spots medially. Medial plates 3–5 with brown spots more numerous; plates 4–5 yellow to brown and, if yellow, anchor-shaped markings of third instar obscured; plates 7–8 with brown spots more numerous. Lateral plates transparent, each with brown margins broken and sometimes reduced to large brown spot at base of pseudointersegmental line on plates 2–7; small brown spots often more numerous but may be absent. Ventrally, linear sclerite posterior to each metacoxa reduced to 1–4 brown spots. Sterna yellow; medial plates reduced or transparent, to transparent with a few small brown spots; sclerotized stripes on intersegmental lines between segments 2–3, 3–4, and 4–5 not evident.

FIFTH INSTAR (Fig. 7). Length, 9.30 ± 0.09; width, 5.38 ± 0.12. Dorsum of head and thorax with punctures more numerous in some areas and generally relatively smaller.

Head with posterior margin yellow to yellowish brown, yellow to yellowish brown oval spot near eye of third and fourth instars now broadly crescent-shaped. Antennal segment 1 yellow to reddish, with brown spots; segment 2 yellow to red, with brown spots; segments 3–4 red to yellowish red, apex of segment 4 darker; ratio of antennal segment lengths ca. 7:22:15:19. Ventral surface of head without pink spot beneath beak, brown mark either side of midline along posterior margin of head often reduced or absent.

Humeri with brown spots more numerous and extended anteriorly in band along each lateral margin. Meso- and metanotal wing pads ca. same length, extending onto third abdominal segment. Pleura yellow, brown spot at base of each coxa, propleura each with brown mark present laterally, other brown spots and brown stripes of fourth instar absent. Coxae white, without central brown spot on lateral surface; femora and tibiae yellowish, with red to brown spots.

Medial plates 3–5 with brown spots more numerous; plate 6 reduced or absent. Lateral plates with brown margins much reduced, large brown spot at base of pseudointersegmental lines still present but limited to 3–7, other small brown spots of fourth instar absent or much reduced. Ventrally, linear sclerite posterior to each metacoxa not evident; medial plates generally obscure or absent, brown spots absent.

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